

**N- AND P-Channel Logic Level Enhancement Mode MOSFET**

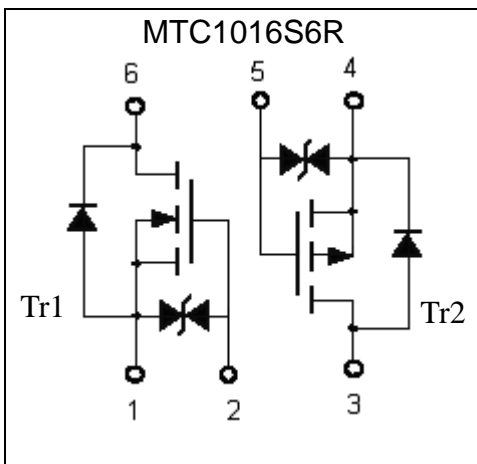
# MTC1016S6R

	N-CH	P-CH
$BV_{DSS}$	20V	-20V
$I_D @ V_{GS}=(-)4.5V, T_A=25^\circ C$	0.82A	-0.57A
$R_{DSON}(typ.) @ V_{GS}=(-)4.5V$	0.30 $\Omega$	0.61 $\Omega$
$R_{DSON}(typ.) @ V_{GS}=(-)2.5V$	0.43 $\Omega$	1.00 $\Omega$
$R_{DSON}(typ.) @ V_{GS}=(-)1.8V$	0.63 $\Omega$	1.64 $\Omega$

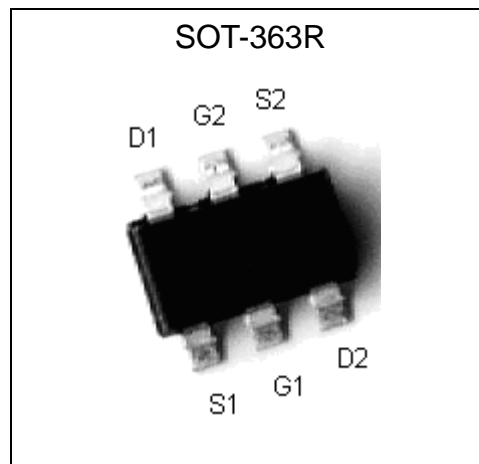
**Features**

- Low on-resistance
- ESD protected gate
- High speed switching
- Low-voltage drive
- Pb-free lead plating and halogen-free package

**Equivalent Circuit**

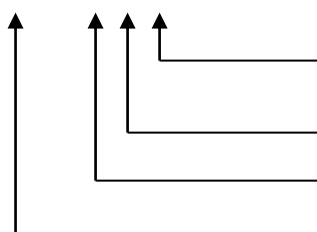


**Outline**



**Ordering Information**

Device	Package	Shipping
MTC1016S6R-0-T1-G	SOT-363 (Pb-free lead plating and halogen-free package)	3000 pcs / Tape & Reel



Environment friendly grade : S for RoHS compliant products, G for RoHS compliant and green compound products

Packing spec, T1 : 3000 pcs / tape & reel, 7" reel

Product rank, zero for no rank products

Product name



**The following characteristics apply to both Tr1 and Tr2**

**Absolute Maximum Ratings** (TA=25°C, unless otherwise noted)

Parameter	Symbol	Limits		Unit
		N-channel	P-channel	
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	20	-20	V
Gate-Source Voltage	V <sub>GS</sub>	±8	±8	V
Continuous Drain Current @TA=25 °C, VGS=4.5V(-4.5V)	I <sub>D</sub>	0.82	-0.57	A
Continuous Drain Current @TA=70 °C, VGS=4.5V(-4.5V)	I <sub>D</sub>	0.66	-0.46	A
Pulsed Drain Current (Note 1)	I <sub>DM</sub>	3.4	-2.3	A
Power Dissipation @TA=25°C	P <sub>D</sub>	0.30		W
Power Dissipation @TA=70°C		0.18		
Operating Junction and Storage Temperature Range	T <sub>j</sub> ; T <sub>stg</sub>	-55~+150		°C

Note : 1. Pulse width limited by maximum junction temperature.  
 2. Pulse width ≤ 300µs, duty cycle ≤ 2%.  
 3. Surface mounted on minimum pad of FR-4 board, t ≤ 5s.

**Thermal Performance**

Parameter	Symbol	Limit	Unit
Thermal Resistance, Junction-to-Ambient(PCB mounted) (Note)	R <sub>th,ja</sub>	415	°C/W

Note : Surface mounted on minimum pad of FR-4 board, t ≤ 5s.

**N-Channel Electrical Characteristics (Tj=25°C, unless otherwise noted)**

Symbol	Min.	Typ.	Max.	Unit	Test Conditions
<b>Static</b>					
BV <sub>DSS</sub>	20	-	-	V	V <sub>GS</sub> =0V, I <sub>D</sub> =250µA
V <sub>GS(th)</sub>	0.5	0.8	1.2		V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250µA
I <sub>GSS</sub>	-	-	±5	µA	V <sub>GS</sub> =±8V, V <sub>DS</sub> =0V
I <sub>DSS</sub>	-	-	1		V <sub>DS</sub> =20V, V <sub>GS</sub> =0V
	-	-	10		V <sub>DS</sub> =16V, V <sub>GS</sub> =0V (T <sub>j</sub> =70°C)
*R <sub>DS(ON)</sub>	-	0.30	0.40	Ω	V <sub>GS</sub> =4.5V, I <sub>D</sub> =600mA
	-	0.43	0.56		V <sub>GS</sub> =2.5V, I <sub>D</sub> =400mA
	-	0.63	0.82		V <sub>GS</sub> =1.8V, I <sub>D</sub> =350mA
*G <sub>FS</sub>	-	1.1	-	S	V <sub>DS</sub> =10V, I <sub>D</sub> =400mA
<b>Dynamic</b>					
C <sub>iSS</sub>	-	58.5	-	pF	V <sub>DS</sub> =16V, V <sub>GS</sub> =0V, f=1MHz
C <sub>oSS</sub>	-	12.3	-		
C <sub>rSS</sub>	-	7.8	-		
t <sub>d(ON)</sub>	-	6	-	ns	V <sub>DS</sub> =10V, I <sub>D</sub> =250mA, V <sub>GS</sub> =4.5V, R <sub>G</sub> =10Ω
t <sub>r</sub>	-	6	-		
t <sub>d(OFF)</sub>	-	26	-		
t <sub>f</sub>	-	20	-		



Qg	-	0.79	-	nC	V <sub>DS</sub> =10V, I <sub>D</sub> =250mA, V <sub>GS</sub> =4.5V
Qgs	-	0.09	-		
Qgd	-	0.27	-		
<b>Source-Drain Diode</b>					
*I <sub>S</sub>	-	-	0.82	A	
*I <sub>SM</sub>	-	-	3.4		
*V <sub>SD</sub>	-	0.75	1.0	V	V <sub>GS</sub> =0V, I <sub>S</sub> =150mA

\*Pulse Test : Pulse Width ≤300μs, Duty Cycle≤2%

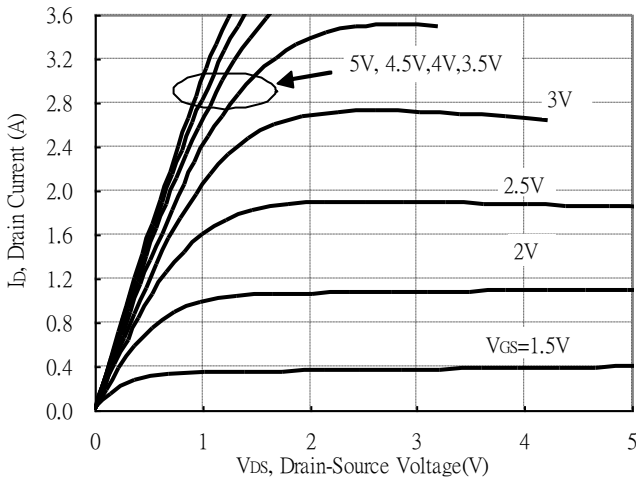
**P-Channel Electrical Characteristics (T<sub>j</sub>=25°C, unless otherwise noted)**

Symbol	Min.	Typ.	Max.	Unit	Test Conditions
<b>Static</b>					
BV <sub>DSS</sub>	-20	-	-	V	V <sub>GS</sub> =0V, I <sub>D</sub> =-250μA
V <sub>GS(th)</sub>	-0.5	-	-1.2		V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA
I <sub>GSS</sub>	-	-	±5	μA	V <sub>GS</sub> =±8V, V <sub>DS</sub> =0V
I <sub>DSS</sub>	-	-	-1		V <sub>DS</sub> =-20V, V <sub>GS</sub> =0V
	-	-	-10		V <sub>DS</sub> =-16V, V <sub>GS</sub> =0V (T <sub>j</sub> =70°C)
*R <sub>DS(ON)</sub>	-	0.61	0.75	Ω	V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-430mA
	-	0.65	0.96		V <sub>GS</sub> =-4V, I <sub>D</sub> =-300mA
	-	1.00	1.30		V <sub>GS</sub> =-2.5V, I <sub>D</sub> =-300mA
	-	1.64	2.40		V <sub>GS</sub> =-1.8V, I <sub>D</sub> =-10mA
*G <sub>FS</sub>	-	0.7	-	S	V <sub>DS</sub> =-10V, I <sub>D</sub> =-250mA
<b>Dynamic</b>					
C <sub>iSS</sub>	-	54.7	-	pF	V <sub>DS</sub> =-16V, V <sub>GS</sub> =0V, f=1MHz
C <sub>oSS</sub>	-	16.6	-		
C <sub>rSS</sub>	-	11.9	-		
t <sub>d(ON)</sub>	-	6	-	ns	V <sub>DS</sub> =-10V, I <sub>D</sub> =-250mA, V <sub>GS</sub> =-4.5V, R <sub>G</sub> =10Ω
t <sub>r</sub>	-	10	-		
t <sub>d(OFF)</sub>	-	23	-		
t <sub>f</sub>	-	28	-		
Qg	-	1.13	-	nC	V <sub>DS</sub> =-10V, I <sub>D</sub> =-250mA, V <sub>GS</sub> =-4.5V
Qgs	-	0.09	-		
Qgd	-	0.42	-		
<b>Source-Drain Diode</b>					
*I <sub>S</sub>	-	-	-0.57	A	
*I <sub>SM</sub>	-	-	-2.3		
*V <sub>SD</sub>	-	-0.79	-1.2	V	V <sub>GS</sub> =0V, I <sub>S</sub> =-150mA

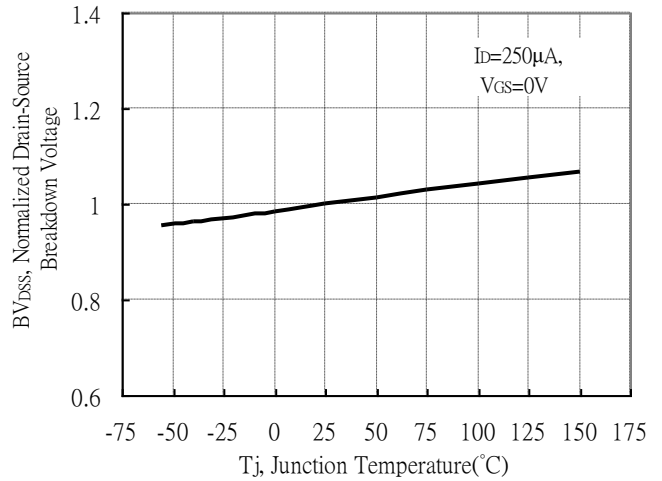


## N-Channel Typical Characteristics

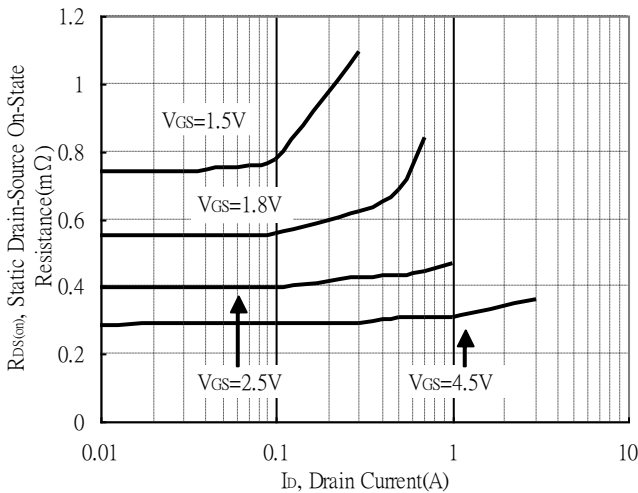
Typical Output Characteristics



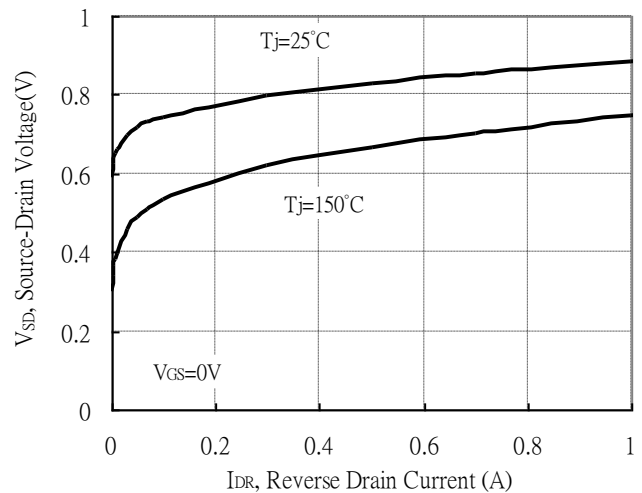
Breakdown Voltage vs Ambient Temperature



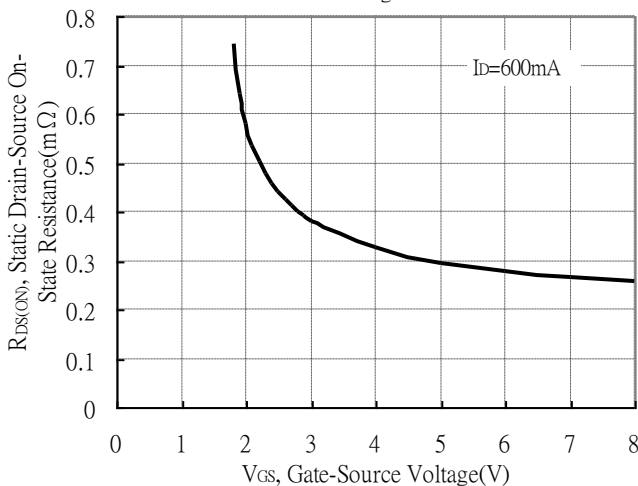
Static Drain-Source On-State resistance vs Drain Current



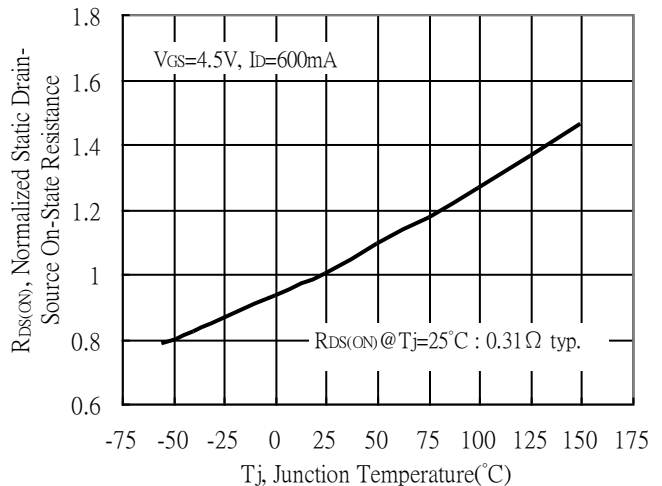
Reverse Drain Current vs Source-Drain Voltage



Static Drain-Source On-State Resistance vs Gate-Source Voltage

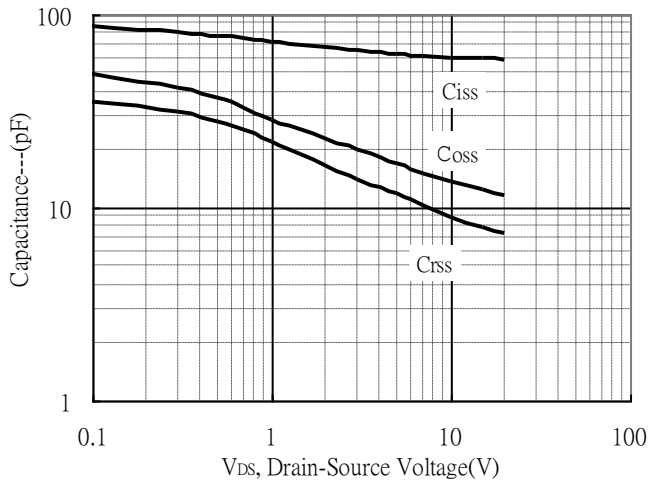


Drain-Source On-State Resistance vs Junction Temperature

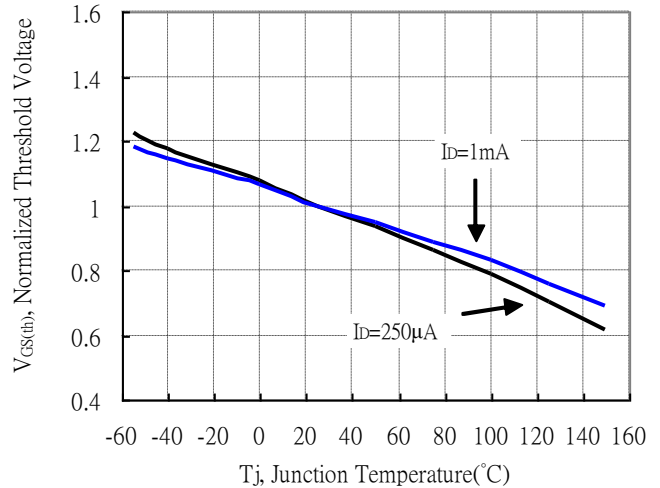


## N-Channel Typical Characteristics(Cont.)

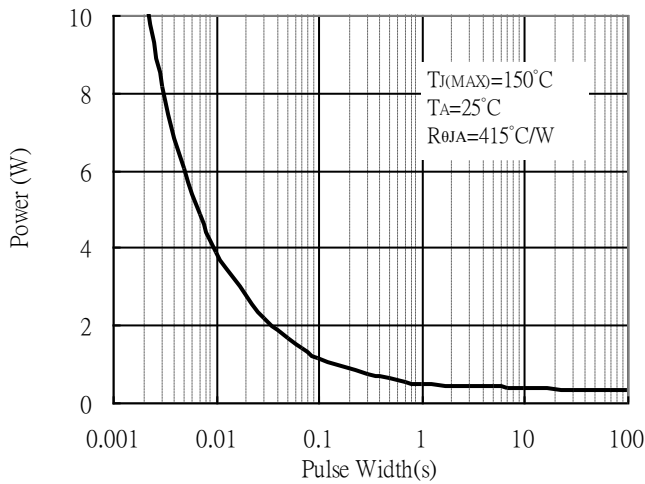
Capacitance vs Drain-to-Source Voltage



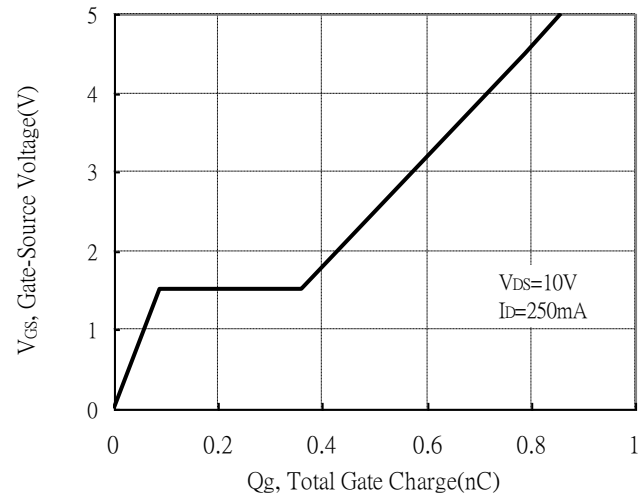
Threshold Voltage vs Junction Temperature



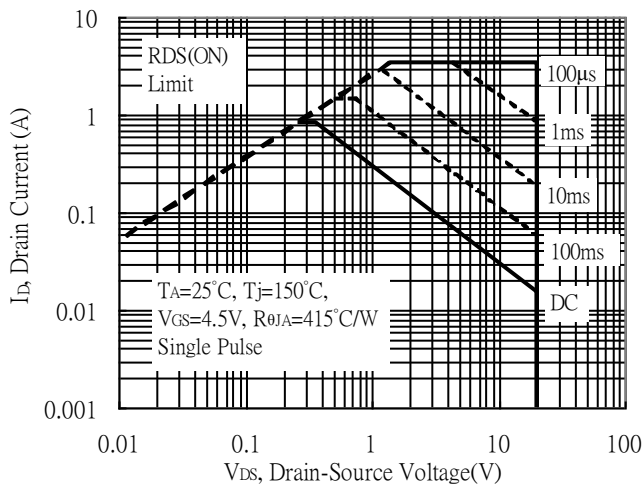
Single Pulse Power Rating, Junction to Ambient  
 (Note on page 2)



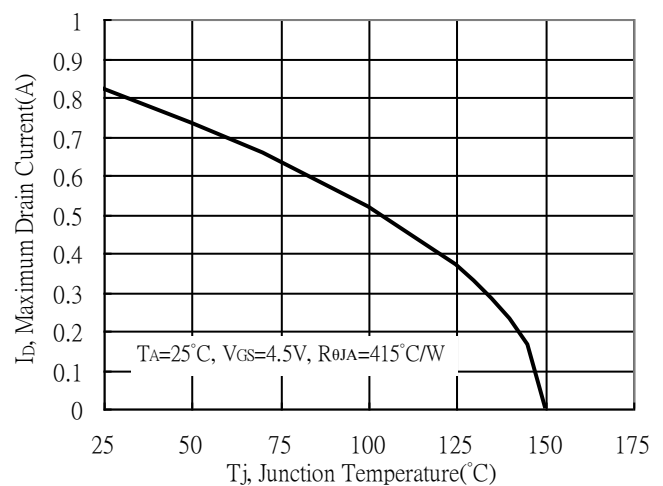
Gate Charge Characteristics



Maximum Safe Operating Area



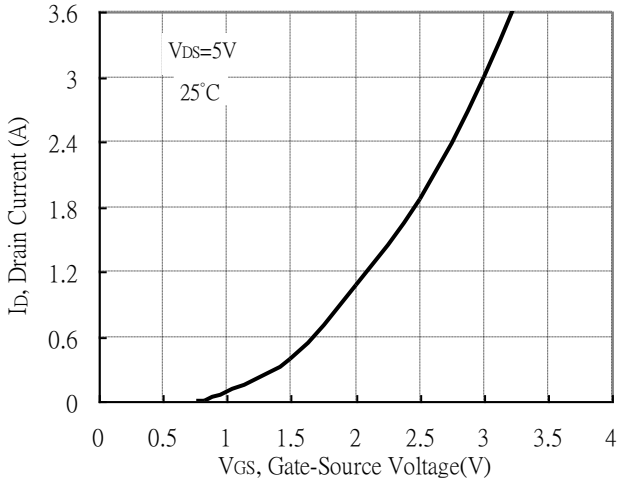
Maximum Drain Current vs Junction Temperature



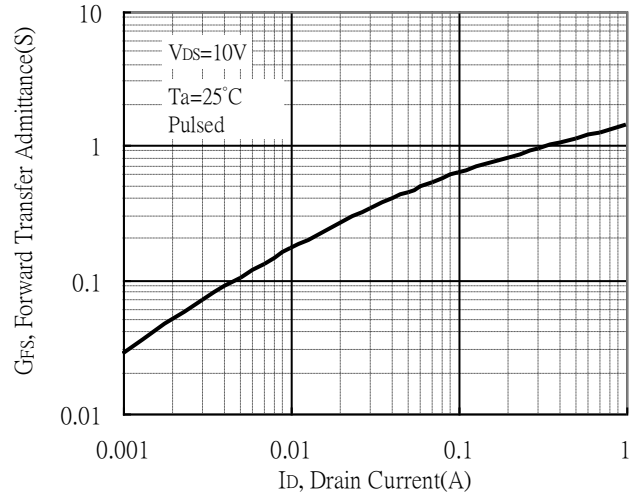


**N-Channel Typical Characteristics(Cont.)**

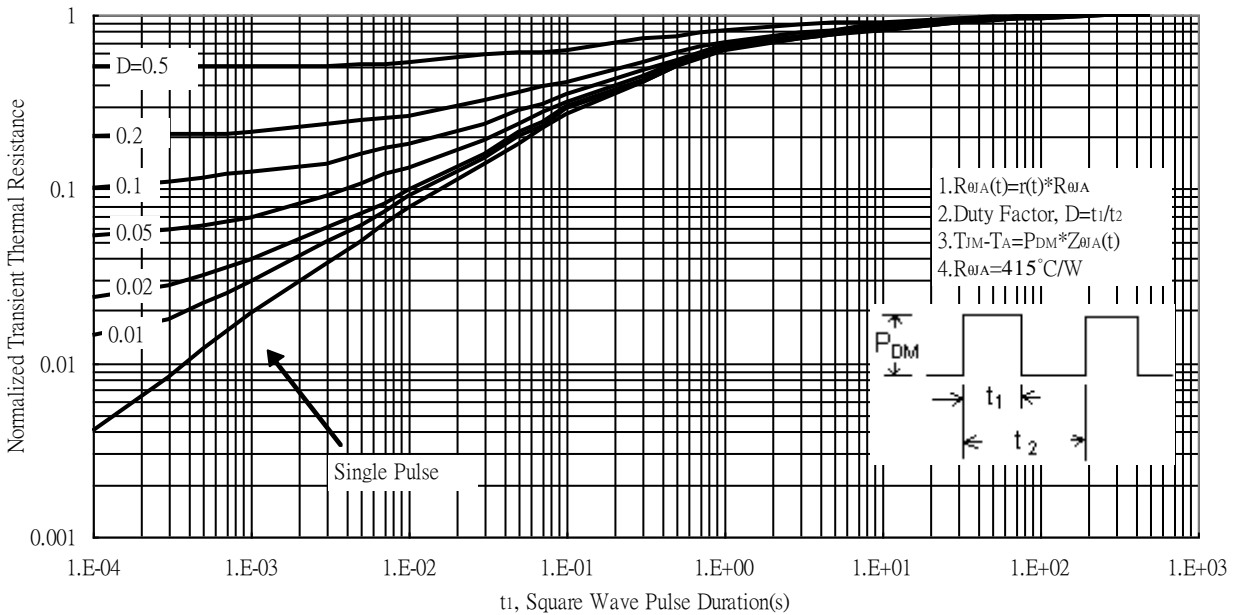
Typical Transfer Characteristics



Forward Transfer Admittance vs Drain Current

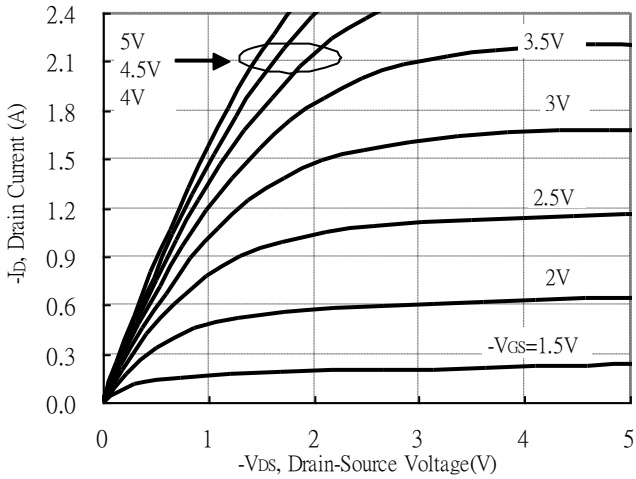


Transient Thermal Response Curves

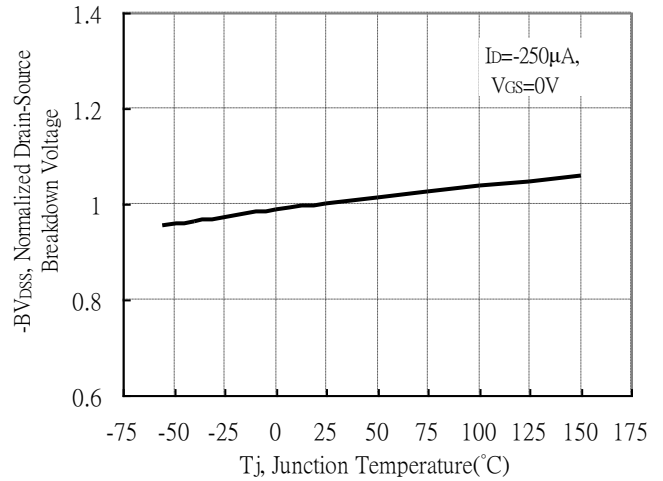


## P-Channel Typical Characteristics

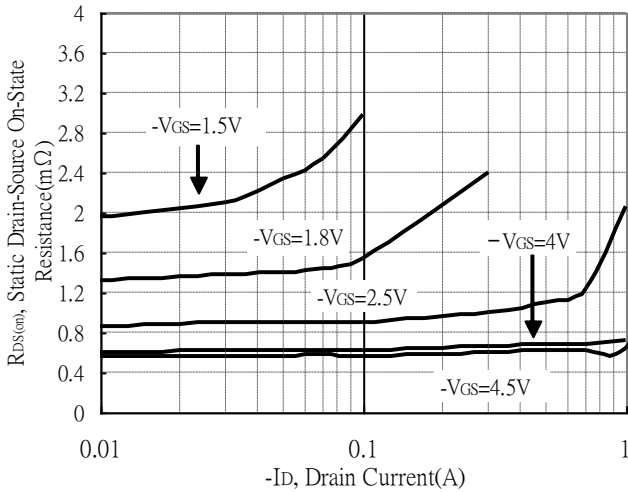
Typical Output Characteristics



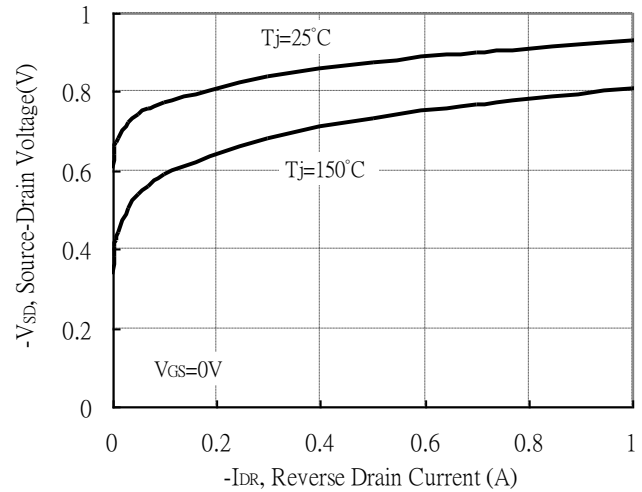
Brekdown Voltage vs Ambient Temperature



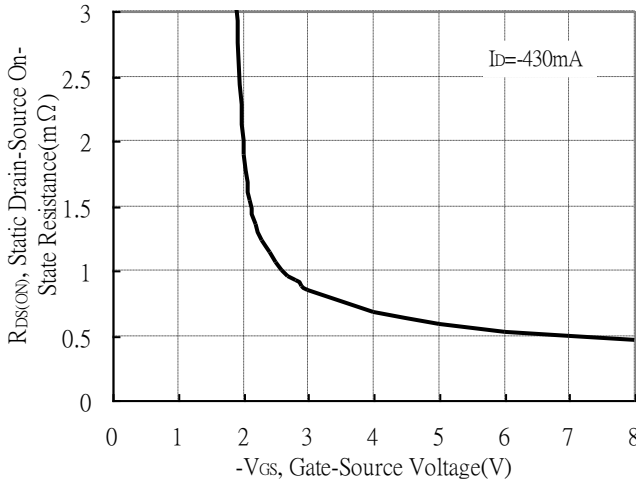
Static Drain-Source On-State resistance vs Drain Current



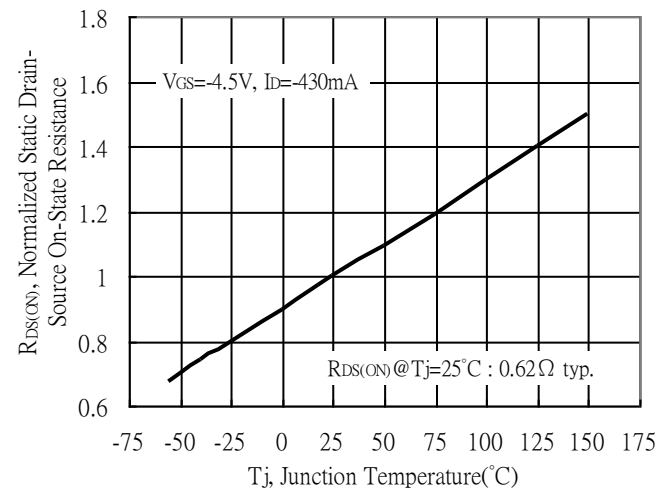
Reverse Drain Current vs Source-Drain Voltage



Static Drain-Source On-State Resistance vs Gate-Source Voltage

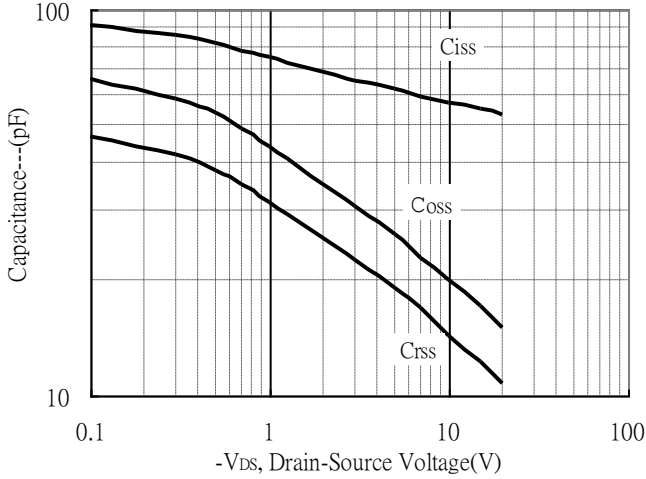


Drain-Source On-State Resistance vs Junction Temperature

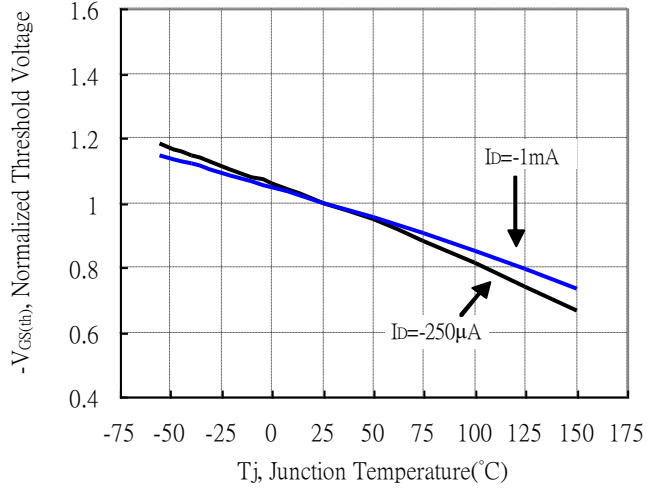


**P-Channel Typical Characteristics(Cont.)**

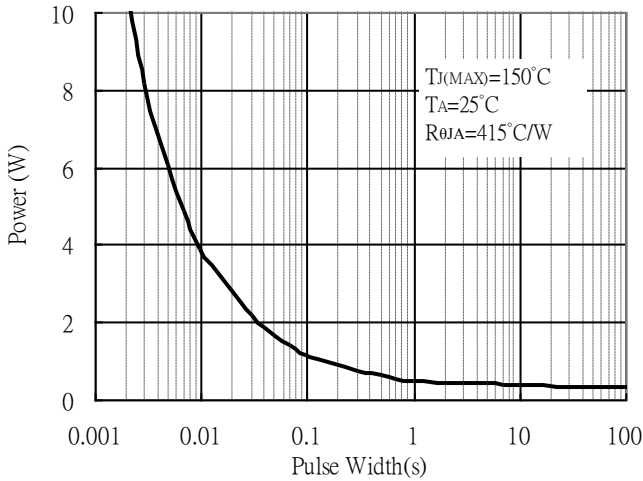
Capacitance vs Drain-to-Source Voltage



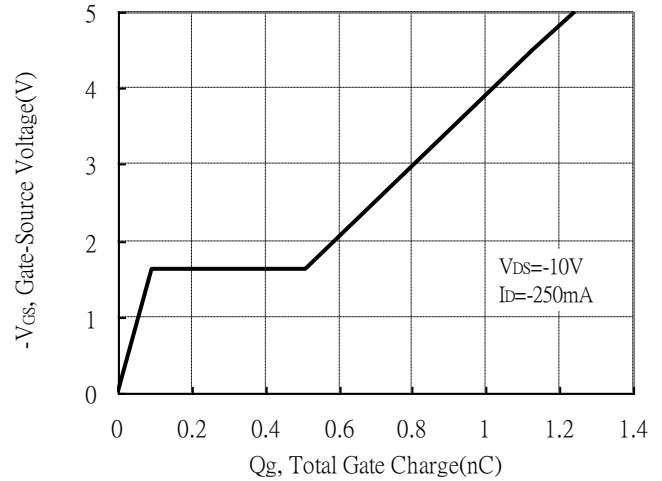
Threshold Voltage vs Junction Temperature



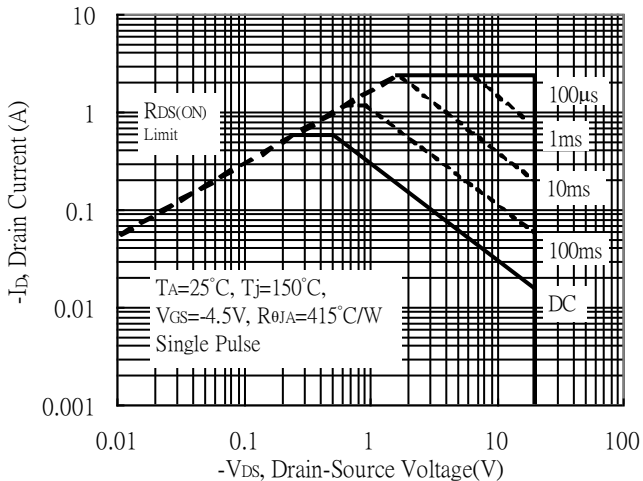
Single Pulse Power Rating, Junction to Ambient  
 (Note on page 2)



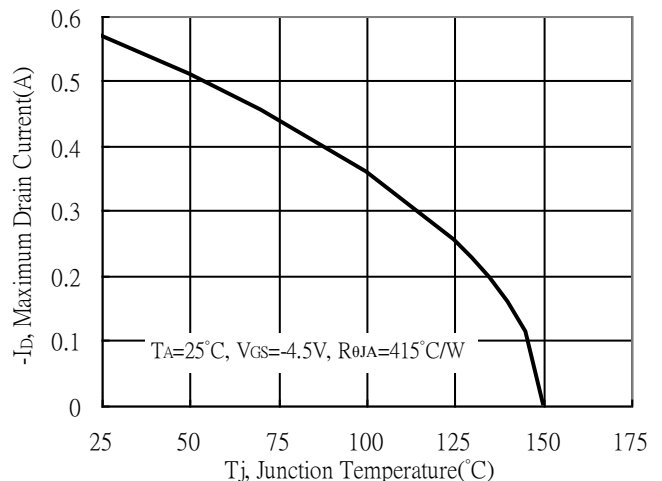
Gate Charge Characteristics



Maximum Safe Operating Area



Maximum Drain Current vs Junction Temperature

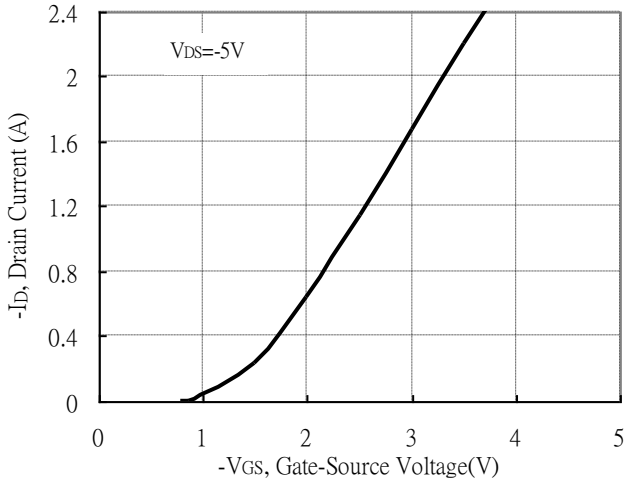




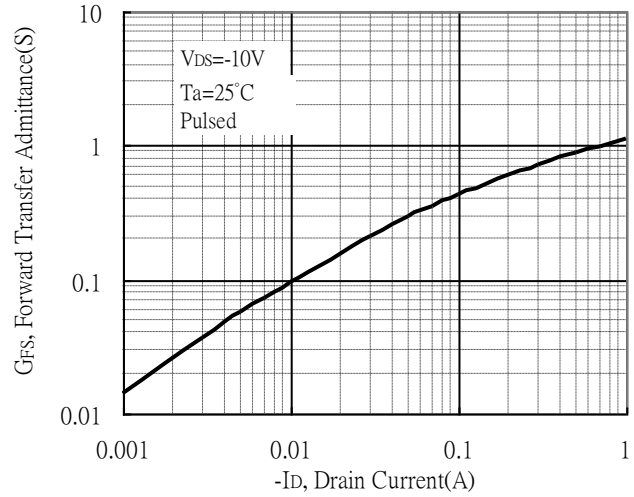


### P-Channel Typical Characteristics(Cont.)

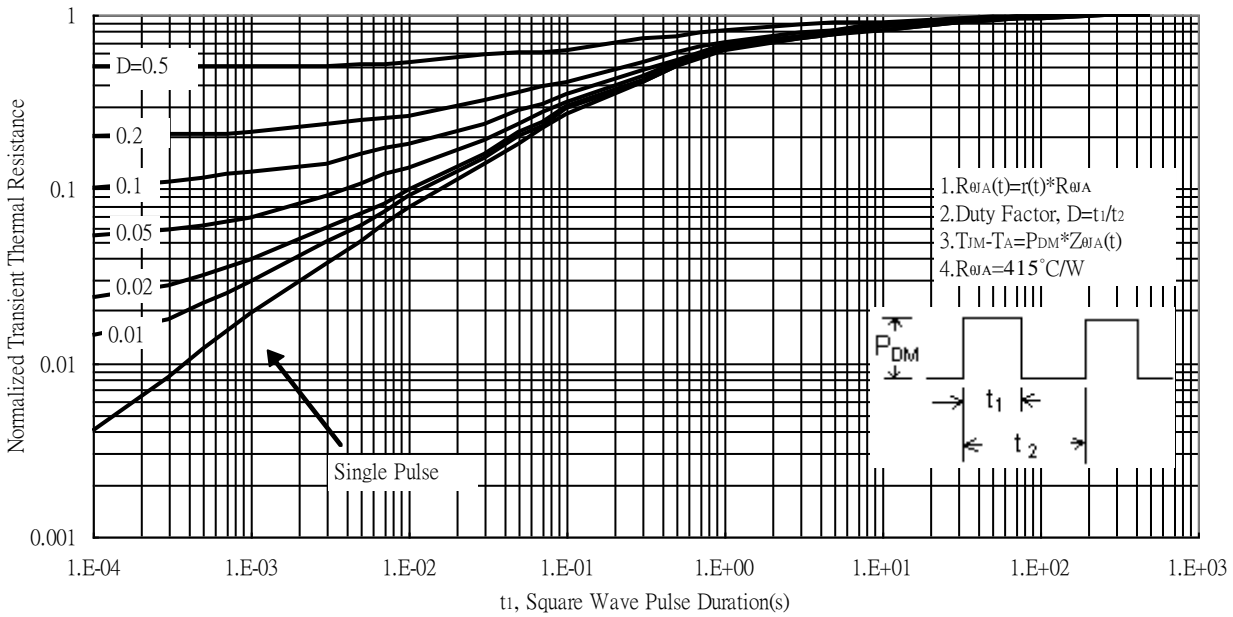
Typical Transfer Characteristics



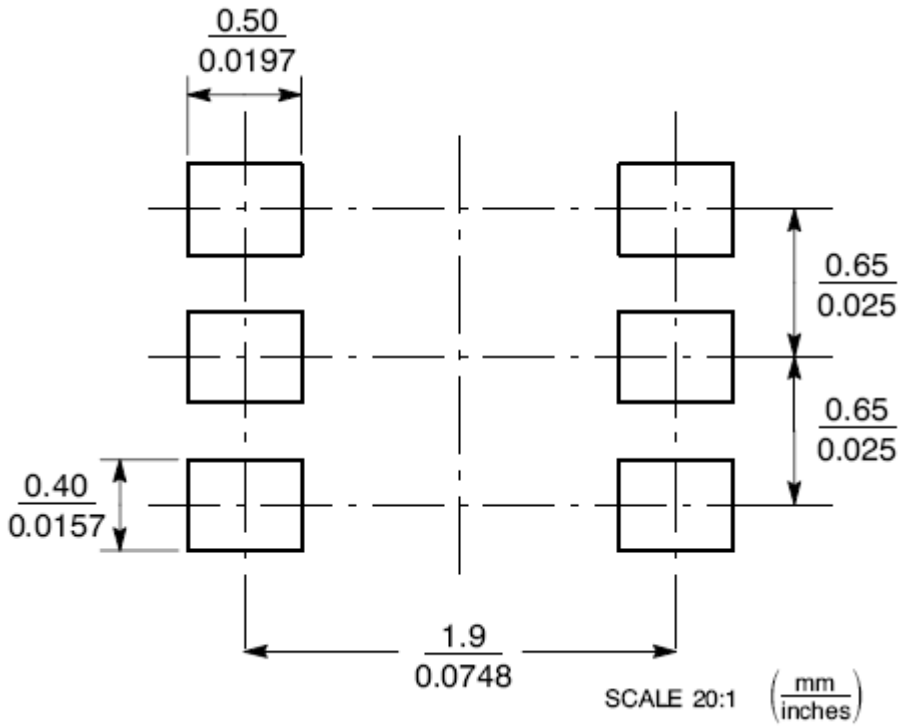
Forward Transfer Admittance vs Drain Current



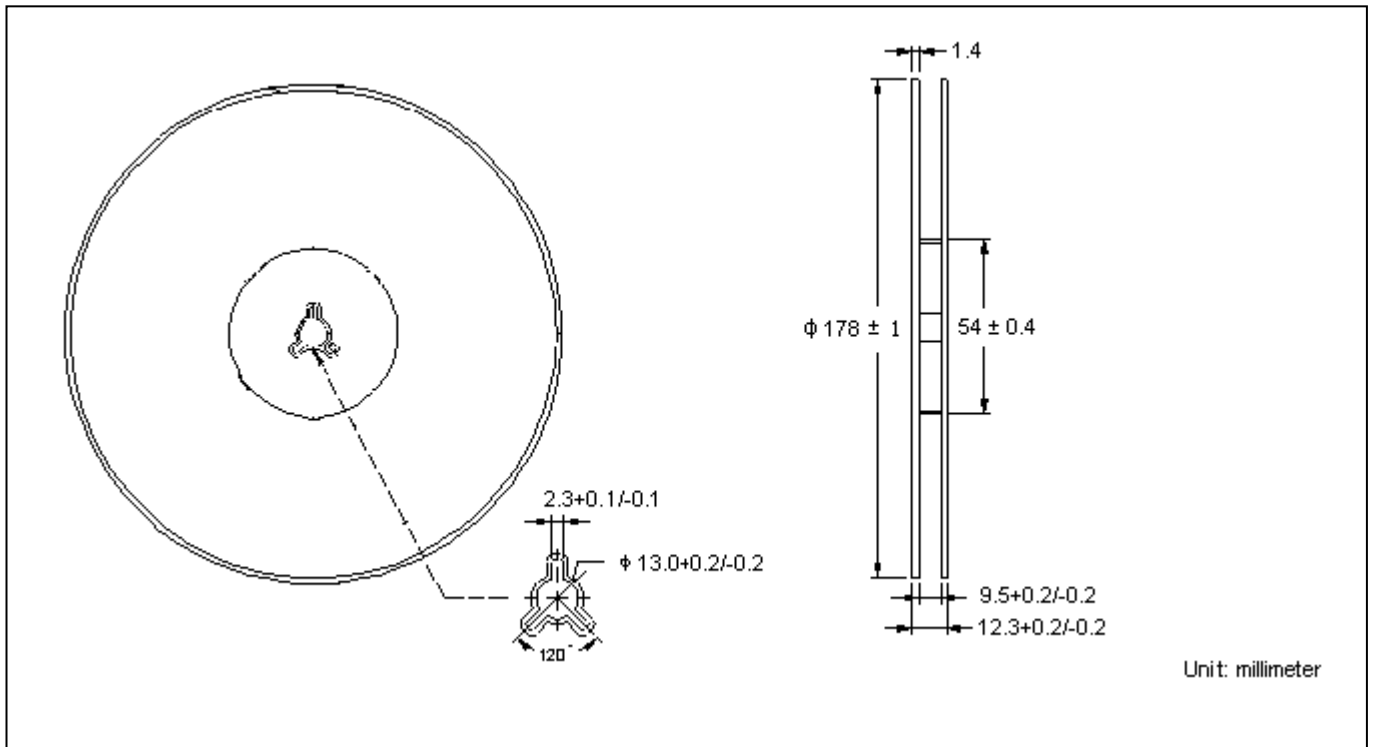
Transient Thermal Response Curves



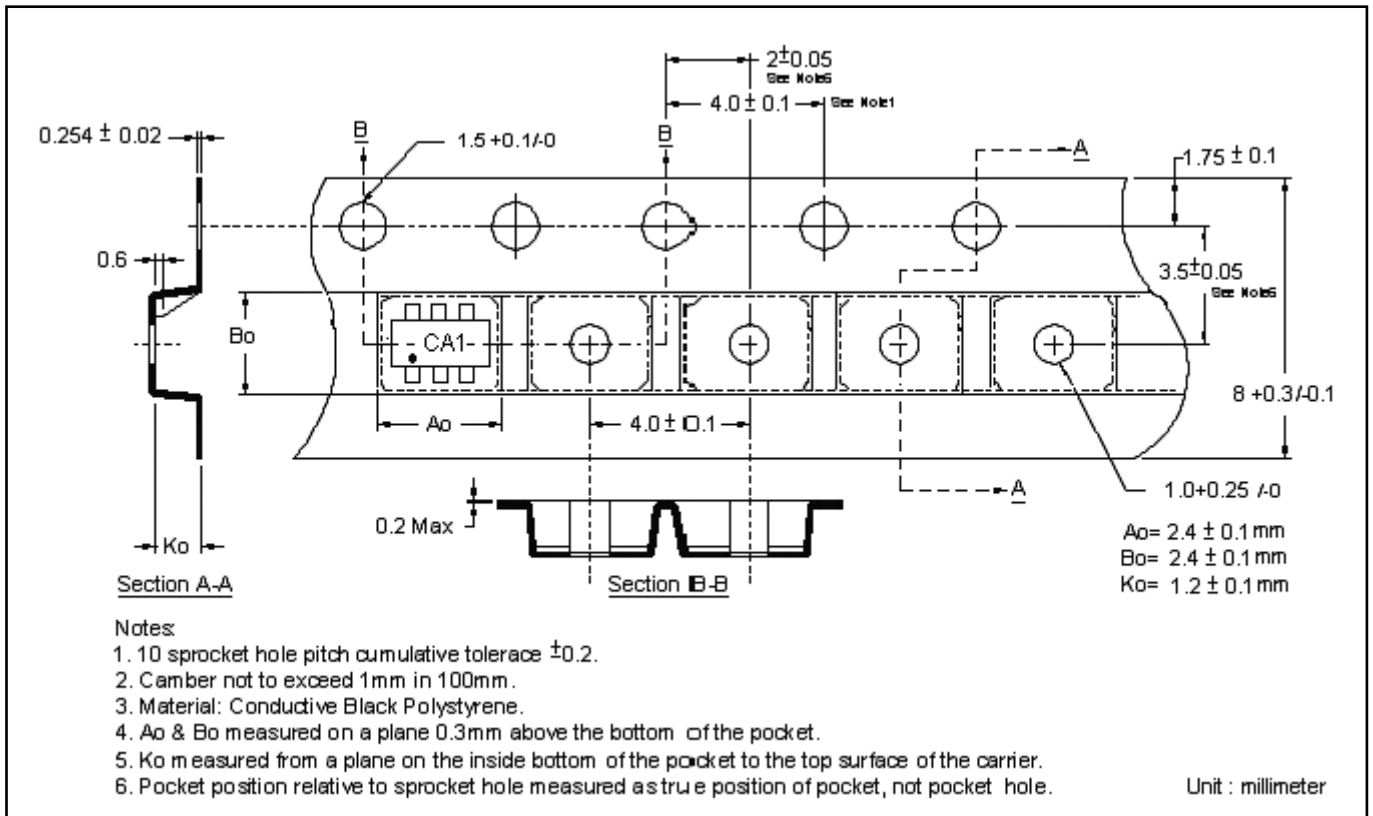
### Recommended Soldering Footprint



**Reel Dimension**



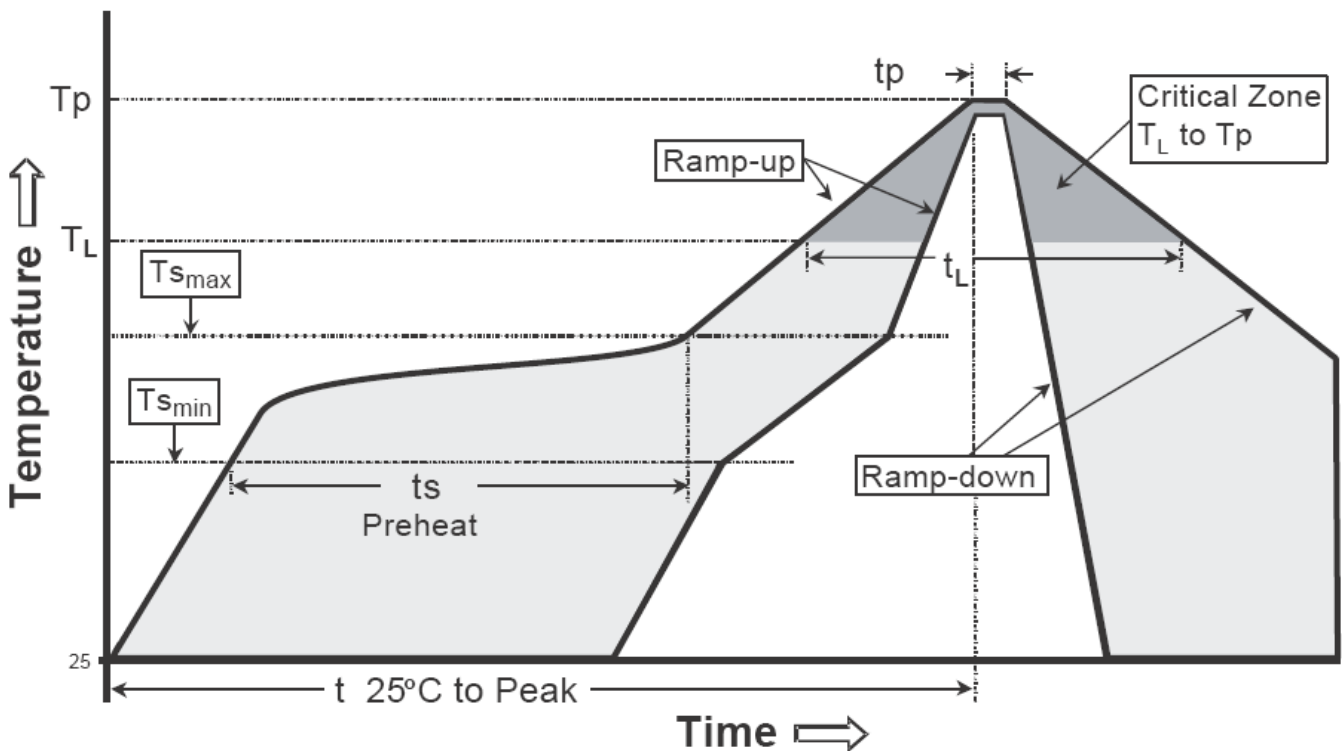
**Carrier Tape Dimension**



**Recommended wave soldering condition**

Product	Peak Temperature	Soldering Time
Pb-free devices	260 +0/-5 °C	5 +1/-1 seconds

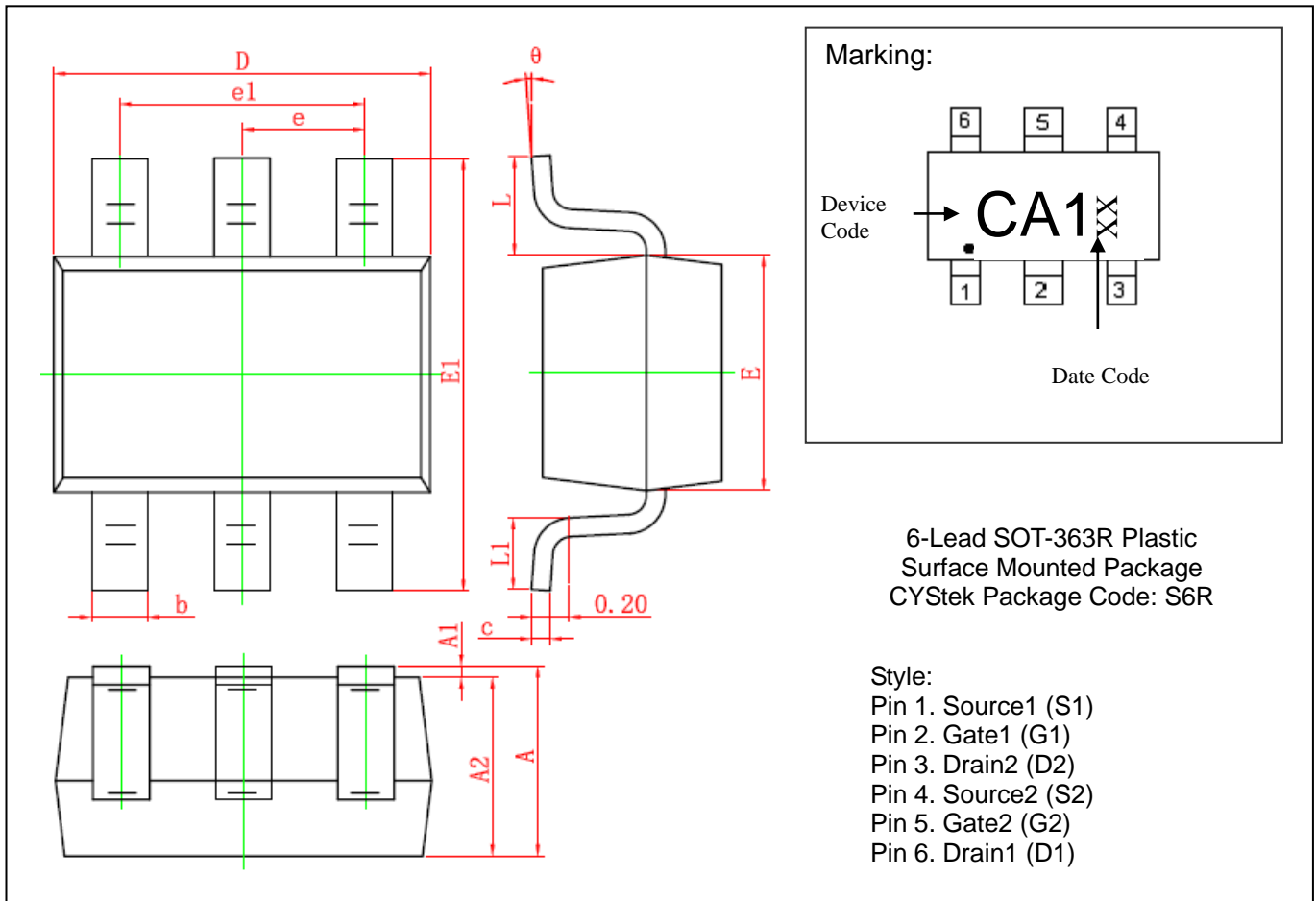
**Recommended temperature profile for IR reflow**



Profile feature	Sn-Pb eutectic Assembly	Pb-free Assembly
Average ramp-up rate (T <sub>smax</sub> to T <sub>p</sub> )	3°C/second max.	3°C/second max.
Preheat		
-Temperature Min(T <sub>s min</sub> )	100°C	150°C
-Temperature Max(T <sub>s max</sub> )	150°C	200°C
-Time(t <sub>s min</sub> to t <sub>s max</sub> )	60-120 seconds	60-180 seconds
Time maintained above:		
-Temperature (T <sub>L</sub> )	183°C	217°C
- Time (t <sub>L</sub> )	60-150 seconds	60-150 seconds
Peak Temperature(T <sub>p</sub> )	240 +0/-5 °C	260 +0/-5 °C
Time within 5°C of actual peak temperature(tp)	10-30 seconds	20-40 seconds
Ramp down rate	6°C/second max.	6°C/second max.
Time 25 °C to peak temperature	6 minutes max.	8 minutes max.

Note : All temperatures refer to topside of the package, measured on the package body surface.

**SOT-363 Dimension**



DIM	Millimeters		Inches		DIM	Millimeters		Inches	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.900	1.100	0.035	0.043	E1	2.150	2.450	0.085	0.096
A1	0.000	0.100	0.000	0.004	e	0.650 TYP		0.026 TYP	
A2	0.900	1.000	0.035	0.039	e1	1.200	1.400	0.047	0.055
b	0.150	0.350	0.006	0.014	L	0.525 REF		0.021 REF	
c	0.080	0.150	0.003	0.006	L1	0.260	0.460	0.010	0.018
D	2.000	2.200	0.079	0.087	θ	0°	8°	0°	8°
E	1.150	1.350	0.045	0.053					

**Notes :** 1.Controlling dimension : millimeters.  
 2.Maximum lead thickness includes lead finish thickness, and minimum lead thickness is the minimum thickness of base material.  
 3.If there is any question with packing specification or packing method, please contact your local CYStek sales office.

**Material :**

- Lead : Pure tin plated.
- Mold Compound : Epoxy resin family, flammability solid burning class:UL94V-0.

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